

ART. II.—*The Silurian Rocks of the Whittlesea District.*

BY J. T. JUTSON.

WITH AN APPENDIX ON THE FOSSILS COLLECTED,

BY F. CHAPMAN, A.L.S., ETC.

(With Plates III., IV.).

[Read 12th March, 1908.]

INTRODUCTION.

The area dealt with in this paper is the whole of that comprised in the Geological Survey Quarter Sheet 3 S.E., the southerly portion of Quarter Sheet 3 N.E., and the northerly portion of Quarter Sheet 2 N.E. Whittlesea is the most central township of this district.

This block of country has the granitic rocks of Mount Disappointment in the north, and basaltic rocks in the south-west; but Silurian rocks form the major portion, and it is with them only that this paper is concerned. The contour of the Silurian area has the usual undulating appearance of Silurian country of moderate altitude in Victoria.

PREVIOUS WORK.

This appears to have been restricted to the mapping many years ago by the old Geological Survey¹; to the determination by the late Prof. McCoy² of some of the fossils collected by the Survey; and to some records by Mr. Chapman from near the Yan Yean³. The work of the field surveyors determined the boundaries very accurately of the various geological formations; and

1 Quarter Sheets, 3 S.E. and 3 N.E., by Norman Taylor, 1857 and 1858. Quarter Sheet 2 N.E., by Robert Etheridge, Jr., 1868.

2 Prod. Pal. Vic., Decades v. and vi. and Quarter Sheet 3 N.E. List of fossils from 13b. 15, 16, 17.

3 Vic. Nat., vol. xx., 1904, p. 165.

Prof. McCoy, from the palæontological evidence, was enabled to prove the Silurian age of the older sedimentary formations, and to suggest¹ that fossils from certain localities were indicative of the base of the Upper Silurian (Silurian), a suggestion that Mr. Chapman in his Appendix to this paper, by his determination of their Melbournian age, now confirms. There was not sufficient material to indicate the geological structure of the rocks, nor to subdivide them palæontologically.

Since the work of the Survey, many more sections have been revealed by road cuttings; and these have enabled me to collect many fossils and to record observations by which the general geological structure may be ascertained, and the beds subdivided.

LITHOLOGICAL CHARACTERS.

The rocks throughout the area are on the whole extremely uniform in general lithological characters. They vary from thin bedded shales and mudstones of very fine grain to fairly thick bedded, coarse-grained micaceous sandstones, which are often siliceous. The finer grained rocks are generally rubbly, often conchoidal in fracture, soft under the hammer, generally contain little mica, and possess a considerable variety of colours. They are, if anything, characteristic of the Melbournian division of this area. The coarser grained rocks often contain much mica, are usually brown or yellow in colour, are frequently mottled, and possess more pronounced joints than the finer grained series. They are more indicative of the Yeringian division in this district.

The only distinctive bands are the sandstone, noted by Mr. Chapman under section V² in the Appendix, as containing starved forms of *Camarotoechia decemplicata*, Sow. sp., and a shelly limestone. The former is found forming a line of reef containing small quartz veins, on a hill to the south of Mount Phillippi. The same kind of rock (but so far as I have observed, without quartz veins), containing similar fossils, is found at Mount Phillippi, and also at section XIII. As the occurrences at the line of reef

¹ Quarter Sheet, 3 N.E.

² This and the other numbers in Roman numerals refer to the fossiliferous sections marked on the accompanying map. In the Appendix the same numbers are used to indicate the same sections.

and at section XIII. are about the same distance from the axis of the great anticline described below, it is possible that this is a distinctive band.

The limestone referred to is found at section VII. on the Cemetery Hill road. It is about 2 feet thick, and exposed along the road for about 35 feet. The rock is a tough, dense, compact, sandy limestone of dark grey colour. It is composed almost wholly of brachiopod shells, which, as usual in limestones, are only clearly seen on weathering. The fossils may be detected in abundance here, as many blocks have been cut away and removed to the side of the road, thus allowing the weather to develop the organisms. A noticeable feature is the number of a very large form of *Spirifer*, described by Mr. Chapman in the Appendix. A possible representative of this limestone is found at section VI., but as the arenaceous constituents of the rocks at the latter section predominate over the calcareous, the conditions of formation were somewhat different.

GEOLOGICAL STRUCTURE.

The map accompanying this paper (which, in its topography and geological boundaries,¹ has been compiled from the Quarter Sheets of the area) records the dips², copied from such Quarter Sheets, together with the additional ones taken by myself. These show that the general geological structure of the district is simple—a great anticline, and a well-defined syncline, separated by a fault.

The anticline may be traced for about 9 miles from the Yan Yean Reservoir, northward to the south-west of Mount Disappointment. Its axis runs from Barber's Creek some distance in a northern direction west of, but approximately parallel to, the railway line, the main Whittlesea road and the Plenty River. As it approaches the township of Whittlesea, it turns towards the north-west, and runs parallel to Bruce's Creek, a north-westerly tributary of the Plenty River. This coincidence of the axial line of the anticline with the direction of the Plenty River and Bruce's Creek valleys,

¹ For simplicity I have ignored the Alluvial and Post-Pliocene indicated on the Quarter Sheets.

² Indicated by double-headed arrows.

is worthy of note. As regards the cause of the deviation of the anticline itself, it may be that the granitic intrusion of the Mount Disappointment rocks is the determining factor. The average dip of the beds is about 50 deg., so that the anticline forms a broad, fairly gentle fold. This is borne out where the actual axis can be seen, as at Barber's Creek, in Quarter Sheet 2 N.E. and at the Glenburnie road, near the main road from Whittlesea to Wallan. At the latter section the anticline appears to have a slight pitch to the north. I have located only one minor fold in the main anticline. This fold—a syncline—is determined by the sections along the Cemetery Hill road. It does not appear to extend far either to the north or to the south. The beds of the anticline exposed on each side of its axis occupy, in a horizontal line, about 2 miles. The rocks are, as will be subsequently shown, of Melbournian age. From the structural and palæontological importance of this fold, I propose, (following Prof. Gregory's nomenclature)¹ to distinguish it as the "Whittlesea Anticlinal."

The other main structural feature is the syncline observed near the junction of the Cemetery Hill and the Merriang roads. Its axial line crosses the former road about 100 yards to the east of the junction of the roads just mentioned², but such line has so far been definitely traced a very short distance. The syncline, however, is no minor fold, as the low angles maintained for about a mile on each side of the axial line demonstrate. The fold must therefore have been a broad, far-reaching one, but its septa have been removed by denudation. The strike on the eastern side of the axis averages about N. 40 deg. E., with a corresponding north-westerly dip at an angle of about 10 deg. The strike of the western side is about N. 50 deg. W. on the average, with a corresponding north-easterly dip at about the same angle as the other side. We have thus a "nosing in" to the south, with an increasing divergence of strike to the north. This "nosing in" gives rise to a series of V-shaped outcrops in ground plan. Whether this structure continues for any considerable distance, either to the north or to the south, it is at present impossible to say, on account of the paucity of dips in the former

¹ The Heatheotian. Proc. Roy. Soc. Vict., vol. xv. (n.s.), pt. ii. (1902), p. 171.

² Some apparent dips at the very small sections marked ix. on the map, would if correct, throw the axial line a little further to the east; but in view of the clearness of the road sections, these may be disregarded.

direction and the basaltic flows in the latter. The syncline pitches to the north, and the axial line can be drawn in a northerly direction for about one mile, but beyond this it is uncertain. The rocks are, as indicated later, mainly of Yeringian age, and as the syncline, therefore, is of importance structurally and palaeontologically, I suggest that the name of the "Merriang Synclinal" be given to it.

There is a third possible structural feature—a fault. As already noted, the strike of the eastern side of the syncline is about N. 40 deg. E., the strata dipping at about 10 deg. The strike of the western leg of the Whittlesea anticlinal along the Cemetery Hill road is from 5 deg. to 10 deg. west of north, with a dip at an angle of about 50 deg. If the strike lines be continued to the north of the road just mentioned, they will meet at an acute angle. The only satisfactory explanation is a fault, and apparently a strike fault, so far as the Whittlesea anticlinal beds are concerned. The pitch of the Merriang Synclinal may have been caused by this fault, and the rocks of this fold would be on the downthrow side. The amount of the displacement is at present unascertainable. The probable course of the fault for about $2\frac{1}{2}$ miles is indicated on the map. How far it continues cannot at present be said. Perhaps a cross fault occurs near to, but to the west of, Mount Phillippi. The section accompanying this paper indicates the general structure along the Cemetery Hill road.

FOSSILIFEROUS SECTIONS.

These, with the exception of XII. and XIII., have been dealt with, as regards the fossils, by Mr. Chapman in the Appendix.

Some of the sections are excellent, both for fossils and for structural evidence. Amongst these are III., VII., VIII. and XII. At the last named, *Pleurodictyum megastomum*, Dun, is the only fossil yet determined. Section III. is identical with Bb 15 on Quatrer Sheet 3 N.E. At section VII. a richly fossiliferous ferruginous sandstone occurs under the shelly limestone. Section VI. is the richest of all for fossils (trilobites and brachiopods being especially abundant); but the rocks are merely small blocks thrown out in grubbing trees. Most of the other records are either very small sections or outcrops, and where the dip is not indicated on the map, there is not sufficient

information, as a rule, to determine it. IX. represents two sections, whose fossils have become mixed, but they are both in the Yeringian area. The fossils from section X. Mr. Chapman classes as of doubtful horizon, no doubt from their scarcity and want of characteristic fossils; but the map shows that these rocks come within the Yeringian area. Section XI. has not been carefully examined, but will probably be found to be Yeringian.

AGE, EXTENT AND THICKNESS OF THE BEDS.

Mr. Chapman has shown in the Appendix that the fossils collected indicate rocks of Melbournian and Yeringian age, with probable Passage beds. With this assistance, I have been enabled to indicate the areas of the respective series on the map attached. The Melbournian is practically coincident with the Whittlesea Anticlinal. There is in addition the small triangular block between the fault and the Passage beds. The rocks of this piece of country form part of the Merriang Synclinal, and are conformable to the Passage beds and the Yeringian. As they are below the Passage beds they must, for the present, be regarded as Melbournian. This will be an interesting point to settle, as if it is Melbournian, we shall then have Melbournian, Passage beds and Yeringian all conformable to one another.

The Passage beds occur at sections VI. and VII., and their field relations justify the view that the rocks at these sections form part of the same set of beds. I have therefore connected them on the map.

The area of the undoubted Yeringian rocks is small, forming part only of the Merriang Synclinal; but their northward extension will no doubt subsequently be proved.

As regards thickness, allowing an average inclination of 50 deg. for the beds in the Whittlesea Anticlinal, and assuming there is no undiscovered repetition of the beds, I estimate the thickness of the exposed Melbournian series at between 7000 feet and 8000 feet.

Taking the average angle of the known Yeringian beds at 10 deg., and with the Passage beds as a base, the thickness of the Yeringian series, as comprised within the area of the fossiliferous sections, would be about 750 feet.

The rocks along the Cemetery Hill Road between the fault and the probable Passage beds, have a thickness of about 600 feet.

SUMMARY OF CONCLUSIONS.

The Silurian rocks of the district consist structurally of a great anticlinal fold, called the Whittlesea Anticlinal, and an important synclinal fold, called the Merriang Synclinal, separated by a strike fault.

Palæontologically they can be subdivided into the Melbournian series (coincident with the Whittlesea Anticlinal) and the Yeringian series (to which part of the Merriang Synclinal belongs), such series being divided by probable Passage beds containing a rich fauna.

The estimated thickness of the Melbournian series is between 7000 feet and 8000 feet, while that of the Yeringian is about 750 feet.

A shelly limestone forming part of such Passage beds is the most striking lithological feature.

Finally, I wish to express my indebtedness to Mr. Chapman in connection with this paper. He has not only most willingly examined and determined all fossils submitted to him, but has throughout my work, aided me with his advice and encouragement.

*Notes on a Collection of Silurian Fossils from the
Whittlesea District, made by Mr. J. T. Jutson.*

By FREDERICK CHAPMAN, A.L.S., Etc.

(National Museum).

(Plates IV., V.).

PRELIMINARY REMARKS.

The following determinations have been made upon a very representative series of fossils from both divisions of the Silurian, the Melbournian and the Yeringian; whilst there also seems to be a special fauna represented at the localities near the

Glenburnie road, and at Cemetery Hill road, which may for the present be regarded as a passage bed between the two divisions, or possibly a basement bed of the Yeringian, containing *Dalmanites meridianus* at a higher horizon than usual.

The majority of the fossils are represented either as casts in mudstone or sandstone. As is often the case, the mudstone casts afford very perfect squeezes in wax, in which all the minutiae of a well-preserved fossil may be made out, with the additional advantage of structure produced by weathering, and not generally seen in the thoroughly mineralised fossils. Thus the vascular system of *Atrypa reticularis* is often shown with surprising clearness in the mudstone casts from the Glenburnie beds, and the same may be said of a species of *Orthis* (*Rhipidomella*) which occurs in the Merriang road beds, which shows both muscular and vascular impressions.

LISTS OF FOSSILS.

The numbers refer to localities so marked on map.

Melbournian Series.

I.—Yan Yean ; from the tunnel to Reservoir.

Crinoids, indet. Columnars only, of a slender-stalked species ; usually found in great abundance in a fine-grained sandstone.

Chonetes melbournensis, Chapm. Found both in the sandstone and mudstone. These examples are smaller than those from the South Yarra mudstone.

Nucula, sp.

Encrinurus, sp.

?*Phacops*.

Besides these forms I have already recorded from the same locality, *Hyolithes novellus*, Barr., and *Bellerophon*, sp., in addition to *Phacops* and *Encrinurus*, whilst the *Chonetes* was previously referred to as *Chonetes cf. melbournensis*¹.

II.—Corner of Kinglake and Jack's Creek Roads.

Camarotoechia decuplicata, Sow. sp.

Rhynchotrema liopleura, McCoy sp.

¹ Viet. Naturalist, vol. xx., 1901, p. 165.

Rhynchonellid, indet.

?*Nucula lamellata*, J. Hall.

III.—Wallan Road.

Crinoids, indet. Remains of the columnars of a slender-stalked species. cf. *Chonetes*.

Orthis sp.

Camarotoechia decemplicata, Sow. sp. Common.

Rhynchotrema liopleura, McCoy sp. Very common.

Rhynchotrema formosa, McCoy sp. Several.

?*Athyris*¹

cf. *Palæoneilo* or *Nuculites*.

IV.—Wallan Road.

Chonetes melbournensis, Chapm.

Camarotoechia decemplicata, Sow. sp.

Rhynchotrema liopleura, McCoy sp.

Probably Melbournian.

V.—From line of reef, S. of Mt. Phillippi.

Camarotoechia decemplicata, Sow. sp. A number of impressions in hard pinkish sandstone, of a starved variety. The lithological condition of this bed, and the aggregated shells, are closely matched in other occurrences of the lower division of the Victorian Silurian; whilst strata of similar character have not been observed, so far as I am aware, in the Yeringian series.

Probably Passage beds between the Melbournian and Yeringian series, but showing more of the faunal characters of the latter.

VI.—From Creek near Glenburnie Road.

?*Zaphrentis*, showing tendency to rejuvenescent habit of growth.

¹ This fossil may be related to those referred by Mr. R. Etheridge, Junr. (see Monthly Prog. Rep., No. 3, 1899, Geol. Surv. Vict., p. 24), to "*Brachiopod allied to *Atrypa mawi*, Dav.*" Mr. Etheridge also records other more or less indeterminate fossils from the same district, and remarks that the fossils "are of Upper Silurian age, but whether high or low in that series, there is not sufficient evidence to determine."

- ?Cyathophyllum.
 Pleurodictyum megastomum, Dun.
 Monticulipora sp.
 Crinoid columnars.
 Stropheodonta alata, Chapm.
 Leptaena rhomboidalis, Wilckens sp.
 ?Chonetes.
 Orthis (Dalmanella) canaliculata, Lindström.
 Orthis (Dalmanella) elegantula, Dalman.
 Orthis (Dalmanella) testudinaria, Dalman.
 Rhynchotrema cf. formosa, J. Hall sp.
 Rhynchotrema liopleura, McCoy sp.
 Rhynchotrema cuneata, Dalman.
 Camarotoechia sp.
 Atrypa reticularis, Linn, sp.
 Spirifer perlamellosus, J. Hall, var. densilineata, nov.
 Actinopteria boydi, Conrad sp.
 Proetus rattei, Eth. fil. and Mitch.
 Cyphasps cf. yassensis, Eth. fil. and Mitch.
 Homalonotus sp.
 Phacops cf. sweeti, Eth. fil. and Mitch.
 Dalmanites meridianus, Eth. fil. and Mitch.

VII.—Cemetery Hill Road Limestone Section.

- Crinoid, indet. ; coiled distal end of column.
 Stropheodonta (Brachyprion) lilydalensis, Chapm.
 Strophonella euglyphoides, Chapm.
 Leptaena rhomboidalis, Wilckens sp.
 Orthis (Dalmanella) testudinaria, Dalman.
 Orthis (Dalmanella) elegantula, Dalman.
 Platystrophia biforata, Schloth. sp.
 Camarotoechia decemPLICATA, Sow. sp.
 Rhynchotrema cuneata, Dalman.
 Uncinulus stricklandi, Sow. sp.
 Spirifer perlamellosus, J. Hall, var. densilineata, nov.
 Actinopteria boydi, Conrad, sp.
 Modiomorpha sp.
 A gasteropod (mould), indet.
 Dalmanites meridianus, Eth. fil. and Mitch.

Yeringian Series.

VIII.—Merriang Road.

Pleurodictyum megastomum, Dun.

Crinoid remains (columnars): indet.

?*Lingula*.

Orthis (*Dalmanella*) *testudinaria*, Dalman.

Orthis (*Dalmanella*) *elegantula*, Dalman.

Orthis (*Rhipidomella*) sp.

Camarotoechia decemplicata, Sow. sp.

?*Zygospira*.

Atrypa reticularis, Linn. sp.

Trilobite (*pygidium*) indet.

IX.—Barber's Creek.

Stropheodonta alata, Chapm.

Camarotoechia decemplicata, Sow. sp.

Atrypa reticularis, Linn. sp.

?*Spirifer*.

?*Nucleospira*.

?*Athyris*.

Actinopteria boydi, Conrad sp.

Silurian of Doubtful Horizon.

X.—From Hill West of Glenburnie Road Beds.

Orbiculoidea sp. : probably a new form.

?*Rhynchotrema liopleura*, McCoy sp. Part of a ventral valve, showing strongly accentuated laminae of growth, sometimes met with in this species.

?*Athyris*.

XI.—From "The Gap," near Wallan.

Chonetes cf. *cresswelli*, Chapm. Two small examples, distinct from *C. melbournensis* in having numerous, comparatively strong riblets, becoming divergent near the margin.

Camarotoechia decemplicata, Sow. sp.

Palaeontological Notes.

Pleurodictyum megastomum, Dun.

P. megastomum, McCoy, 1867 (nomen nudum), Ann. Mag. Nat. Hist., ser. 3, vol. XX., p. 201, footnote.

Dun, 1898, Proc. Roy. Soc. Vict., vol. X.N.S., pt. II., p. 83, pl. III., fig. 1.

The specimens in the present collection, from Glenburnie Road and Merriang Road, afford additional evidence of the peculiar habit of this species to attach itself to the stems of crinoids, which character may also hold good for the genus. In a former paper¹ I have drawn attention to this peculiarity and in the case of the Victorian specimens, whose corallum often attains a diameter of over 5 cm., they seem invariably to select a comparatively slender-stalked crinoid for attachment, which must have imposed a heavy burden upon their host. The opportunity is now taken to correct a locality given in my paper above-mentioned (p. 107), caused by a duplication of reference letters and numbers on the Survey specimens, in which the locality B16 as there recorded should read "Simmons' Bridge Hut on the Yarra," and not "West of Mt. Disappointment"; the reference to the latter having been afterwards altered by the Survey to Bb16.

In reference to its distribution it is interesting to note that *P. megastomum* was collected by Mr. G. Sweet from near Kilmore, and probably from about the same horizon as the Glenburnie Road Beds.

Platystrophia biforata, Schlotheim, sp.

The occurrence of the above fossil in strata having a strong Yeringian facies, viz., the Cemetery Hill Road section, affords further evidence of its greater abundance in Victoria in the equivalent of the Wenlock. It has also been found in the Walhalla and Mt. Wellington Districts in Gippsland in strata which may be of similar age².

1 Proc. Roy. Soc. Vict., vol. xv., n.s., pt. ii., 1903, p. 106, pl. xvi., figs. 2-5.

2 Vict. Naturalist, vol. xxiv., 1907, p. 34.

Spirifer perlamellosus, J. Hall, var. *densilineata*, nov.

(Pl. IV., Fig. 1, 2 ; Pl. V.).

Description.—Shell large, semicircular ; extremities obtuse to acutely pointed. Ventral valve gently arcuate, beak well projected beyond the cardinal line ; dorsal valve strongly convex towards the middle. Cardinal area moderately high. Median sinus wide and deep ; median fold moderately wide and somewhat depressed or even concave on the top. On either side of fold and sinus, four strong, subangulate to rounded plications, and indications of two more, near the cardinal line, nearly obsolete. Shell-surface with concentric lamellæ as in the specific form, but more distinct ; radial surface striæ well developed, closely arranged and almost continuous from beak to margins. Width along cardinal line in a typical example, 55 mm. Length from beak to anterior margin, approximately 35 mm.

Observations.—The present variety, *densilineata*, differs from the type form in the more distantly-spaced surface lamellæ of the shell, and the persistent striæ. The type species was described by J. Hall from the Lower Helderberg Group (shaly limestone) of the State of New York.

In a former paper, giving a list of Silurian (Yeringian) fossils from the Croydon District, I included a spirifer there referred to as *S. perlamellosus*, var. nov., and bracketed it with McCoy's *S. sulcata*. The smaller examples of the new variety *densilineata* show certain marked affinities with those figured by McCoy under Hisinger's specific name, and at the time it seemed highly probable that they made a continuous series of one variable species. A further examination of a large number of Yeringian spirifers shows, however, that McCoy was right in regarding his specimens from Yering as identical with Hisinger's species, the chief and fairly constant differences between the two forms *S. perlamellosus*, var. *densilineata*, and *S. sulcatus* being the higher delthyrium, the closer lamellation, more numerous plications, and interrupted striæ of the latter. The Croydon examples should, therefore, be referred to *Spirifer sulcatus*, Hisinger sp.

1 Pal. N. York, vol. iii., 1859, p. 201, pl. xxvi., figs. 1, 2.

2 Vict. Naturalist, vol. xxiii., 1906, p. 239.

S. perlamellosus, var. *densilineata* was found both in the Glenburnie and Cemetery Hill Road sections, and it will probably prove to be a good zone fossil.

Actinopteria boydi, Conrad sp.

Avicula boydi, Conrad, 1842, Journ. Acad. Nat. Sci. Philad., vol. VIII., p. 237, pl. XII., fig. 4.

This species is already known from the Hamilton Group of N. America and the Upper Ludlow of Britain. It is widely distributed in our Yeringian series, having been found at Croydon and at various points in the neighbourhood of Lilydale, in addition to the present occurrence at Glenburnie Road, Cemetery Hill Road and Barber's Creek.

Modiomorpha sp.

Three examples of a modioliform shell occur on one slab from the Cemetery Hill Road section. They are bivalves having a strong umbonal ridge, concentric lamellæ, and expanded posterior cardinal area. A fairly close comparison may be made with *M. concentrica*, Conrad sp.¹ from the Hamilton Group of N. America.

Proetus rattei, Eth. fil. and Mitch.

P. rattei, Eth. fil. and Mitch., 1892, Proc. Linn. Soc., N.S.W., vol. VI., p. 316, pl. XXV., figs. 2, 2a-d.

Two examples of the pygidium of the above species are found in the series of fossils from Glenburnie Road. They show the characters of the described form in the relatively long axis with eight rings and rapid contraction towards the pygidial margin. It is interesting to note the first occurrence of this trilobite in Victoria, the species having been described from the Lower Trilobite Bed of the Bowning Series, of Bowning Creek, Bowning, Co. Harden, New South Wales. The above authors ascribe the horizon doubtfully to the Wenlock.

Phacops sp., cf. *sweeti*, Eth. fil. and Mitch.

A few pygidia of a small variety of *Phacops* allied to the above species¹ occur in the Glenburnie Road material. They have a well-marked and narrow axis and a rounded pygidial border. These fossils may represent a neat variety of the

¹ See Hall and Clarke, Pal. N. York, vol. v., pt. 1 (ii.), 1885, p. 275, pl. xxxvi., figs. 1-18.

² *Phacops fecundus*, McCoy, non Barrande, Proc. Pal. Vict., dec. iii., 1876, p. 15, pl. xxii., figs. 8, 9, pl. xxiii., figs. 1-6.

